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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,774	08/18/2003	James Gardner	021245-000900US	4122

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EXAMINER	
DSOUZA, JOSEPH FRANCIS A	
ART UNIT	**PAPER NUMBER**
2611	

DATE MAILED: 10/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/643,774	GARDNER ET AL.	
	Examiner	Art Unit	
	Adolf DSouza	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 August 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1- 20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,8-10 and 17-20* is/are rejected.

7)☒ Claim(s) *2-7 and 11-16* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 August 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/4/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Drawings

1. The drawings are objected to because:

- In Figure 1, the spelling of "Ungerboec" should be corrected to "Ungerboeck".
- In Figures 2 and 3, the input "R" to elements 32 and 52 should be changed to "**r**" to make it consistent with what is described in the specification.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because of the following informalities:

- On p[age 3, line 1 and page 5, line 19, the dimensions of matrix H should be corrected to M_r x M_t.

Appropriate correction is required.

Claim Objections

3. Claims 1 and 10 are objected to because of the following informalities: In line 3 of each claim, the dimensions of the channel matrix H should be corrected to M_r rows and M_t columns.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 8 – 10, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant Admitted Prior Art in view of Wallace et al. (US 6,473,467).

Regarding claim 1, Applicant Admitted Prior Art discloses a method for decoding symbols transmitted in a multi-input multi-output communications system having M_t transmit antennas and M_r receive antennas, the symbols transmitted via a channel having an associated matrix **H** with M_r rows and M_t columns (Figs. 1,2; Specification, paragraphs 8 - 10) the method comprising: receiving a vector **r** of the transmitted symbols on the M_r receive antennas, wherein the vector **r** has M_r components (Fig. 2; Specification, paragraph 10);

wherein matrix **X** includes (M_{t-1}) rows and 2^{u+n} columns, wherein each transmitted symbol is selected from 2^n cosets each having 2^u labels, wherein n and u each is an integer greater than zero (Fig. 1, elements 14, 16; Specification, paragraph 8);

thereafter finding a distance metric and a label metric associated with each of 14 the remaining transmit antennas for each coset based on $xopt_1$ (Fig. 2, output of element 32; Specification, paragraph 10);

and thereafter finding a distance metric and a label metric associated with the first 20 one of the transmit antennas for each coset based on $\mathbf{xopt_2}$ (Fig. 2, output of element 32; Specification, paragraph 10).

Applicant Admitted Prior Art does not disclose forming estimates of the symbols $\mathbf{xopt_1}$ and $\mathbf{xopt_2}$.

In the same field of endeavor, however, Wallace discloses forming a first vector quantity $\mathbf{xopt_1}$, associated with a first one of the transmit antennas and having elements defined

by a column h_1 of matrix **H** associated with the first antenna, the remaining columns $H_{n\neq1}$ of matrix **H**, and a matrix **X** of possible symbols transmitted on the remaining ones of the transmit antennas and thereafter forming a second vector quantity $\mathbf{xopt_2}$ associated with a second one of the transmit antennas and having elements defined by a column h_2 of matrix H associated with the second antenna, the remaining columns $H_{n\neq2}$ of matrix **H**, and the matrix **X** (column 15, lines 58 - 65).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Wallace, in the Applicant Admitted Prior Art because this would allow estimating the symbols from multiple transmitted antennas, as disclosed by Wallace.

Regarding claim 8, Applicant Admitted Prior Art discloses applying the distance metric and the label metric associated with each transmit antenna to a Viterbi decoder (Fig. 2, element 32 output; Specification, paragraph 10).

Regarding claim 9, Applicant Admitted Prior Art discloses applying the distance metric and the label metric associated with the first transmit antenna to each of the i^{th} to M_t^{th} transitions in the trellis, wherein i is an integer varying from 0 to (M_t-1) (Specification, paragraphs 11 - 12).

Claims 10, 17 are directed to apparatus of the same subject matter claimed in the method/steps claims 1, 8 respectively and therefore, are rejected as explained in the

rejections of claims 1, 8 above.

6. Claims 18 - 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant Admitted Prior Art in view of Wallace et al. (US 6,473,467) and further in view of Cole (US 4,891,823).

Regarding claims 18 – 20, Applicant Admitted Prior Art does not disclose that the modules are implemented in software, hardware or a combination.
In the same field of endeavor, however, Cole discloses the first, second, third and fourth modules is a software / hardware / software and hardware module (column 5, lines 10 - 13).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Cole, in the Applicant Admitted Prior Art because this would allow implementation if software or hardware as is well known in the art.

Allowable Subject Matter

7. Claims 2 – 7, 11 – 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Other Prior Art Cited

The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.

The following patents are cited to further show the state of the art with respect to MIMO systems and Trellis encoders:

El-Gamal et al. (US 20020122502) discloses Method and system for utilizing space-time overlays for convolutionally coded systems.

Piirainen (US 20030012318) discloses a data transmission method and system using MIMO.

Onggosanusi et al. (US 20030016640) discloses space-time encoded wireless communication system with multipath resolution receivers.

Onggosanusi (US 20030048857) discloses a method using Space-time transmit diversity.

Stuber (US 20030076777) discloses apparatus and methods for providing efficient space-time structures for preambles, pilots and data for multi-input, multi-output communications systems.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Adolf DSouza whose telephone number is 571-272-1043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Adolf DSouza
Examiner
Art Unit 2611

AD

MOHAMMED GHAYOUR
SUPERVISORY PATENT EXAMINER